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MEMORANDUM

SUBJECT: Risk from modeled air concentrations due to J.H. Baxter Emissions
NEIC Project: JH Baxter
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FROM: Kristen Keteles, Ph.D., Toxicologist KRISTEN KETELES Digitally signed by KRISTEN KETELES Date: 2024.08.14 12:22:08 -06'00'
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TO: Karla Perrin, Regional Criminal Enforcement Counsel, EPA-Region 10

Summary

The annual air concentrations modeled by Dr. Brad Venner (NEICRP2080X01) were used to assess risk to the nearby community from J.H. Baxter emissions using EPA and ODEQ risk assessment approaches. Risk assessment is a process to characterize the nature and magnitude of risks to human health for a population based upon the exposure and the toxicity of the chemicals. Based on the modeled exposure concentrations for the chemicals with known toxicity, there does not appear to be an appreciable risk of adverse health effects including cancer from the J.H. Baxter emissions for the chemicals with existing toxicity information. However, there is some uncertainty due to the lack of toxicity information for approximately one third of the chemicals. Additionally, studies conducted in communities near wood treatment facilities found elevated levels of dioxin and furans in blood and attic dust as well as the prevalence of adverse health effects in one exposed community. Therefore, risk to the community near J.H. Baxter cannot be ruled out based on the air modeling results alone.

Introduction

Risk is determined based upon toxicity and exposure (EPA 2004). Toxicity is the ability of a substance to produce an adverse effect once it reaches a susceptible site in or on the body. In order to determine risk, a toxicity comparison value or dose which a harmful effect may occur is needed. Exposure is how much contact a person has with a chemical and inhalation exposure is expressed as a concentration in air (i.e. ug/m^3). Duration of exposure is also considered

whether the duration is chronic (long term) or acute (short term). In his analysis, Dr. Venner modeled chronic (annual) exposure concentrations and acute (24 hour) exposure concentrations. Due to the lack of toxicity comparison values for acute exposures to the chemicals, this analysis focuses on chronic exposure and uses the modeled annual concentrations from the J.H. Baxter facility.

EPA Risk Assessment Approach

EPA considers two general types of adverse effects, noncancer and cancer, and are evaluated separately in risk assessment. For noncancer effects such as effects on the liver, heart, kidney, or nervous system, it is assumed that there is a threshold level below which adverse effects are unlikely to occur. A reference concentration (RfC) is an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime (EPA 2002). The exposure concentration is divided by the RfC to determine the hazard quotient (EPA 2004). If the hazard is less than 1 (exposure concentration does not exceed the RfC), adverse health effects are unlikely to result even in sensitive populations. The hazard quotients from multiple chemicals in an emission can be summed to get a hazard index, a measure of total hazard for the emissions.

There is no threshold for cancer effects, and EPA assumes that even at low concentrations the risk is not zero. Because it is assumed that there is no threshold, the toxicity of carcinogens is expressed as an Inhalation Unit Risk (IUR), a probability of getting cancer as a result of being exposed continuously for a lifetime to a concentration of 1 $\mu g/m^3$ (EPA 2005a). The IUR is the relative potency of a carcinogen and is used to calculate excess cancer risk in a population based upon the concentration and the duration of exposure. An age dependent adjustment factor is applied to mutagenic chemicals that are more potent at early life stages (EPA 2005b). EPA uses a target risk range of 10E-4 (1 in 10,000) to 10E-6 (1 in 1,000,000) to manage risks through the Superfund Program and anywhere within this range is considered acceptable for Superfund cleanups (OSWER Directive 9355.0-30). Although the Agency strives to reduce risk to the 10E-6 range, EPA generally uses 10E-4 in making risk management decisions and therefore, a risk of 10E-4 may be considered acceptable.

Annual concentrations calculated by Dr. Venner (NEICRP2080X01) from J.H. Baxter emissions were used to calculate carcinogenic risk and noncancer hazard using EPA's Risk Screening Level Calculator (https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) based upon an exposure duration of one year (Table 1). Because the exposure duration was less than lifetime subchronic RfCs were used when available. The total cancer risk is 2.72E-7 and the total hazard is 0.36 for the chemicals that have IURs and/or RfCs. The cancer risk is less than an excess risk of 10E-6 (1 in a million) from chemicals that have IURs and is considered acceptable by EPA. Furthermore, the total hazard is less than 1 and therefore, adverse health effects are unlikely to result from exposure to the annual concentrations from J.H, Baxter even in sensitive populations from chemicals that have RfCs.

Oregon Department of Environmental Quality Risk Assessment Approach

Oregon Department of Environmental Quality (ODEQ) follows a similar process to assess risk with some differences. ODEQ converts IURs to concentrations using a target excess cancer risk level of one in one million (ODEQ 2022). Like EPA, ODEQ uses an age adjustment factor for chemicals that have increased cancer potency at early life stages. Differing from EPA, ODEQ uses a multipathway adjustment factor to account for exposure through other routes exposure such as water, food and soil. The inhalation risk is multiplied by the adjustment factor to account for risk from other sources of exposure to calculate a risk-based concentration (RBC). The ratio of the exposure concentration to the RBC is determined to obtain the excess cancer risk per million which is summed to determine the total source risk from the facility (ODEQ 2022). The total source risk is rounded and is then compared to the State's Risk Action Level (RAL), a level that facilities must take action. The RAL varies based on the age of the facility. The total rounded source risk from J.H. Baxter based upon the modeled annual concentrations for chemicals that have an RBC is 45 (Table 2) which is under Oregon's Toxics Best Available Control Technology (TBACT) Level of 50, Risk Reduction Level of 200, and Immediate Curtailment Level of 500.

For noncancer effects, ODEQ uses Toxicity Reference Values (TRVs) which may be from EPA, ATSDR, or the State of California to determine noncancer RBCs (ODEQ 2022). Therefore, some of the TRVs may be different from EPA's RfCs. Like EPA, the exposure concentration is divided by the noncancer RBC to determine the hazard quotient. The hazard quotients can be summed to get a hazard index, a measure of the total hazard for the emissions. ODEQ uses TBACT Risk Action Levels of 3 or 5 depending on whether the contaminants cause developmental effects. The hazard index from the annual modeled concentrations from J.H. Baxter emissions is 0.23 (Table 2) and is below the ODEQ Risk Action Levels.

Studies on Residential and Occupational Exposure from Wood Treatment Facilities

There are limited studies on health effects in residents near wood treatment facilities, but they indicate the potential for exposure and adverse health effects in nearby communities. In a study of a community exposed to wood process waste, health effects were significantly more prevalent in 214 long-term residents near the wood treatment plant that utilized pentachlorophenol and creosote than in 139 controls from an unexposed community (Dahlgren et al 2003). The residents near the wood treatment facility had a significantly greater prevalence of mucous membrane and skin irritation, asthma and bronchitis, neurological symptoms, as well as cancer than the unexposed community. Furthermore, elevated levels of dioxin and furans were found in the blood of residents and in attic dust in homes near the wood treatment plant demonstrating that exposure was occurring (Dahlgren et al 2007). Elevated levels of dioxin and furans were also found in the blood and in the attic dust of residents living near four wood preservative facilities (Feng et al 2011). The levels in attic dust in homes near the four facilities exceeded the EPA Regional Screening Levels (RSLs) and could present potential risk to human health. Attic dust in homes near a wood treatment facility in Brazil had elevated levels of pentachlorophenol and polycyclic aromatic hydrocarbons with mutagenic activity (Coronas 2013). These studies demonstrate that communities near J.H. Baxter may be exposed to chemicals through dust which was not evaluated.

There is a paucity of information on worker exposure at wood treatment facilities. In a study of worker exposure conducted at 11 wood treatment and two preservative manufacturing facilities in 1983, airborne levels were below the occupational limit for pentachlorophenol at pressure treatment facilities (NIOSH 1983). There was the potential for brief but significant peak exposures to pentachlorophenol for workers at nonpressure treatment plants at locations adjacent to the treatment tank or vessel. At creosote treatment plants, there was potential for significant exposures to cyclohexane extractable hydrocarbons for very brief periods of time during cylinder or tank unloading. NIOSH concluded that precautions should be taken through the use of work practices to minimize exposure to workers.

Conclusion

When following both EPA's and ODEQ's risk assessment guidance, the modeled annual concentrations from J.H. Baxter fall within acceptable levels when considering cancer risk and noncancer hazard for chemicals that have toxicity values/risk-based concentrations. However, it is important to note that ODEQ lacks RBCs for nine of the 29 chemicals and EPA lacks toxicity values (IUR or RfC) for 11 of the 29 chemicals. That means that 31% and 38% of the chemicals are not considered in the risk determination using the ODEQ and EPA risk assessment approaches, respectively. While the risk is acceptable from inhalation exposure to the chemicals with toxicity comparison values, the risk from exposure to approximately a third of the chemicals emitted from J.H. Baxter is unknown. Additionally, there may be exposure from sources other than air. For example, studies have found elevated levels of dioxins and furans in the blood and attic dust in residents near wood treatment plants and adverse health effects were prevalent in a community near a wood treatment facility. Therefore, residents near J.H. Baxter could be exposed through dust and soil and may still be at risk of adverse health effects. Workers at J.H. Baxter may also have been at risk if precautions were not taken to minimize worker exposure.

attachments

Table 1. Carcinogenic Risk and Noncancer Hazard Index from J.H. Baxter annual modeled concentrations using EPA's Regional Screening Level Calculator. Default inputs were used in the calculator except exposure duration (1 year).

Chemical	IUR $(ug/m^3)^{-1}$	RfC (mg/m^3)	Annual Concentration (ug/m^3)	Carcinogenic Risk	Noncarcinogenic HI
Acenaphthene	-	-	9.20E-03	-	-
Acenaphthylene	-	-	1.00E-04	-	-
Anthracene	-	-	1.90E-03	-	-
Benzo[a]anthracene	6.00E-05		1.00E-03	6.00E-08	
Benzo[a]pyrene	6.00E-04	2.00E-06	3.00E-04	1.78E-07	1.44E-01
Benzo[b]fluoranthene	6.00E-05	-	3.00E-04	1.78E-08	-
Benzo[k]fluoranthene	6.00E-06	-	3.00E-04	1.78E-09	-
*Biphenyl, 1,1'-	-	4.00E-03	2.70E-03	-	6.47E-04
Carbazole	-	-	2.50E-03	-	-
Chrysene	6.00E-07	-	9.00E-04	5.33E-10	-
2-Methylphenol	-	6.00E-01	3.40E-03	-	5.43E-06
Dibenzofuran	-	-	5.10E-03	-	-
Fluoranthene	-	-	6.60E-03	-	-
Fluorene	-	-	4.50E-03	-	-
HpCDF, 1,2,3,4,6,7,8-	3.80E-01	4.00E-06	3.30E-07	1.72E-09	7.91E-05
HpCDD, 1,2,3,4,6,7,8,-	3.80E-01	4.00E-06	6.10E-08	3.18E-10	1.46E-05
HpCDF, 1,2,3,4,7,8,9-	3.80E-01	4.00E-06	2.20E-08	1.15E-10	5.27E-06
HxCDD, 1,2,3,4,7,8-	3.80E+00	4.00E-07	4.80E-09	2.50E-10	1.15E-05
HxCDD, 1,2,3,6,7,8-	3.80E+00	4.00E-07	4.80E-09	2.50E-10	1.15E-05
HxCDD, 1,2,3,7,8,9-	3.80E+00	4.00E-07	1.72E-08	8.95E-10	4.12E-05
HxCDF, 1,2,3,6,7,8-	3.80E+00	4.00E-07	3.45E-09	1.80E-10	8.27E-06
*Methylnaphthalene, 1-	-	3.00E-05	6.40E-03	-	2.05E-01
Methylnaphthalene, 2-	-	-	1.32E-02	-	-
Naphthalene	3.40E-05	3.00E-03	2.26E-02	1.05E-08	7.22E-03
OCDD	1.14E-02	1.33E-04	1.70E-07	2.65E-11	1.22E-06
OCDF	1.14E-02	1.33E-04	2.26E-07	3.53E-11	1.63E-06
Pentachlorophenol	5.10E-06	-	6.00E-04	4.19E-11	-
Phenanthracene	-	-	1.01E-02	-	-
Quinoline	-	-	5.45E-02	-	-
Total Cancer Risk or Hazard Index	-	-	-	***2.72E-07***	***3.56E-01***

Table 2. Cancer Risk and Noncancer Hazard Index from J.H. Baxter annual modeled concentrations using ODEQ approach.

Chemical	Residential Chronic Cancer RBC (ug/m^3)	Residential Chronic noncancer RBC (ug/m^3)	Annual Concentration (ug/m^3)	Excess Cancer Risk	Noncancer Hazard
1-Methylnaphthalene			6.40E-03		
2-Methylnaphthalene			1.32E-02		
2-Methylphenol		6.00E+02	3.40E-03		0.00001
Acenaphthene			9.20E-03		
Acenaphthylene			1.00E-04		
Anthracene			1.90E-03		
Benzo(a)anthracene	2.10E-04		1.00E-03	4.7619	
Benzo(a)pyrene	4.30E-05	2.00E-03	3.00E-04	6.9767	0.15000
Benzo(b)fluoranthene	5.30E-05		3.00E-04	5.6604	
Benzo(k)fluoranthene	1.40E-03		3.00E-04	0.2143	
Biphenyl			2.70E-03		
Carbazole			2.50E-03		
Chrysene	4.30E-04		9.00E-04	2.0930	
Dibenzofuran			5.10E-03		
Fluoranthene	5.30E-04		6.60E-03	12.4528	
Fluorene			4.50E-03		
Naphthalene	2.90E-02	3.70E+00	2.26E-02	0.7793	0.00611
Pentachlorophenol	2.00E-01		6.00E-04	0.0030	
Phenanthracene			1.01E-02		
Quinoline			5.45E-02		
OCDD	1.00E-07	4.20E-04	1.70E-07	1.7000	0.00040
OCDF	3.40E-06	4.20E-04	2.26E-07	0.0665	0.00054
1,2,3,4,6,7,8-HpCDD	1.00E-07	1.30E-05	6.14E-08	0.6140	0.00472
1,2,3,4,6,7,8-HpCDF	1.00E-07	1.30E-05	3.30E-07	3.3000	0.02538
1,2,3,4,7,8,9-HpCDF	1.00E-07	1.30E-05	2.28E-08	0.2280	0.00175
1,2,3,4,7,8-HxCDD	1.00E-08	1.30E-06	4.80E-09	0.4800	0.00369
1,2,3,4,7,8-HxCDF	1.00E-08	1.30E-06	3.45E-09	0.3450	0.00265
1,2,3,6,7,8-HxCDD	1.00E-08	1.30E-06	3.39E-08	3.3900	0.02608
1,2,3,7,8,9-HxCDD	1.00E-08	1.30E-06	1.72E-08	1.7200	0.01323
Total Cancer Risk or Hazard Index				***44.7849***	***0.23457***

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